Accuracy and Precision of Six Intraoral Scanners: Controlled Comparative Analysis

Bagnaresi N,[1] Breschi L,[1] Maltauro M,[2] Meneghello R,[2] Bosco T,[1] Baldissara P,[1]

[1]University of Bologna, DIBINEM, Italy; [2]Univ.of Padova, Padova, Italy;

AIOP 44° International Congress, Bologna, Italy.

Bologna, Nov. 13-15, 2025

PURPOSE

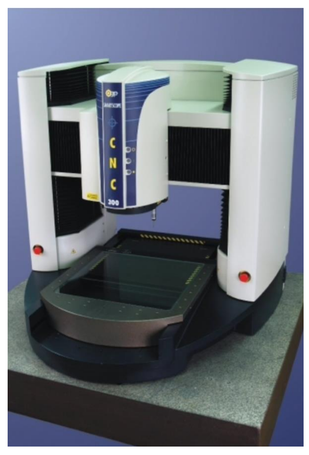
High accuracy and precision of intraoral scanners (IOS) are critical, as scanning errors can affect all subsequent steps involved in the fabrication of prosthetic restorations, potentially compromising the final fit. The aim of this study was to evaluate and compare, in vitro, the accuracy and precision of six different intraoral scanners and to investigate whether operator experience influences these parameters.

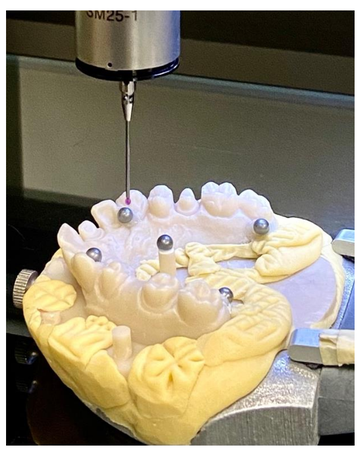
METHODS AND MATERIALS

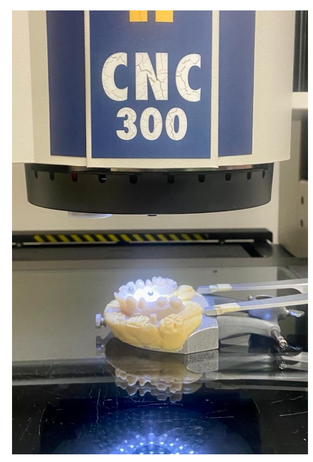
The scanners analyzed were: CS 3700 (Carestream), i700 (Medit), MyScan WL (Cefla), Primescan (Dentsply), Trios 5 (3Shape), and Vivascan (Ivoclar). A maxillary arch reference model was fabricated entirely in zirconia (3Y-TZP) for its high dimensional stability. Four calibration spheres were positioned on the model in accordance with ISO 20896-1:2019. Scanning was performed under simulated clinical conditions using a mannequin. Each scanner was used following the manufacturer's guidelines and protocols established in the literature. To assess the influence of clinical experience, scans were performed by two experienced operators (>10 years of clinical practice) and two novice operators. Each operator completed five scans per device, resulting in 20 scans per scanner. Comparisons were conducted using a metrological protocol developed by the Faculty of Engineering (Padova University, Italy). An optical coordinate measuring machine (OCMM, SmartScope Flash CNC 300), was used to calibrate the reference model. The scanning error for each device was calculated using Zeiss Inspect software (Zeiss, 2025). Statistical analysis was performed to compare the performances of the scanners and to evaluate the influence of the operators' experience. Significance level: α = 0.05.

The zirconia master model

The model mounted on the mannequin prior the intraioral scanning



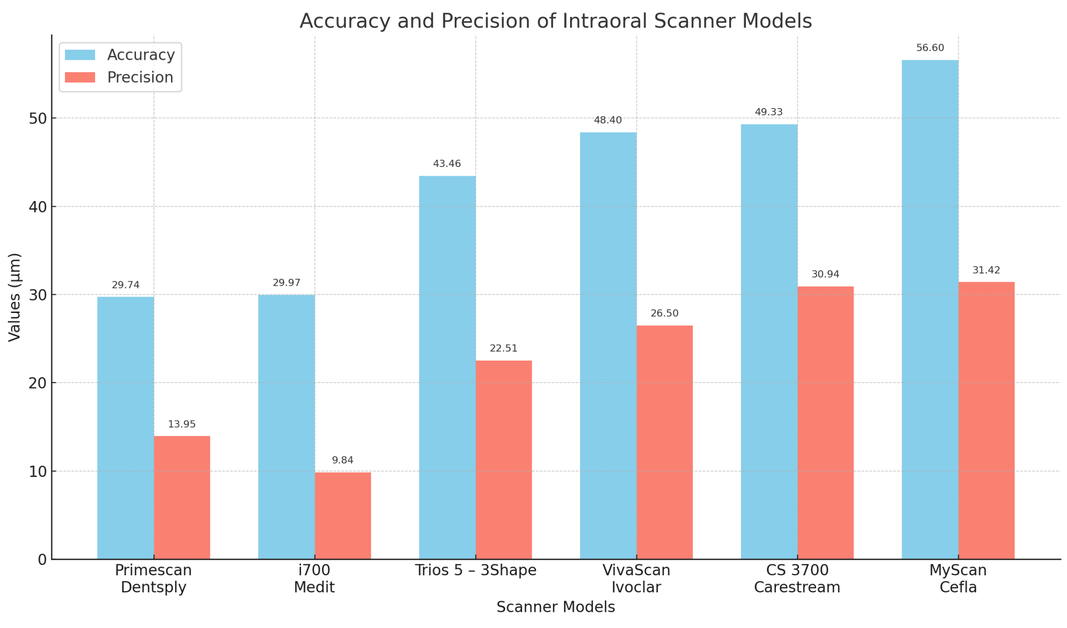


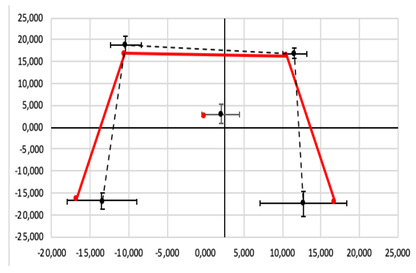


Zirconia model calibration with OCMM, *SmartScope Flash CNC 300*

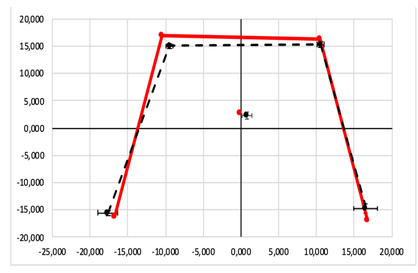
RESULTS

- **Accuracy: Primescan 29.74 µm > Medit 29.97 µm > Trios 43.46 µm > Vivascan 48.40 µm > Carestream 49.33 µm > MyScan 56.60 µm.**
- **Precision: Medit i700 9.84 µm > Primescan 13.95 µm > Trios 22.51 µm > Vivascan 26.50 µm > Carestream 30.94 µm > MyScan 31.42 µm.**
- **No significant differences were found among the operators.**

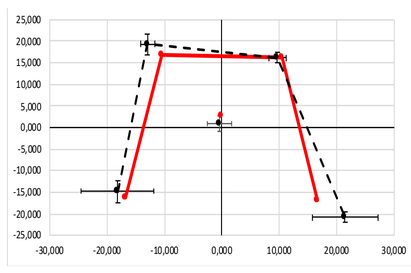




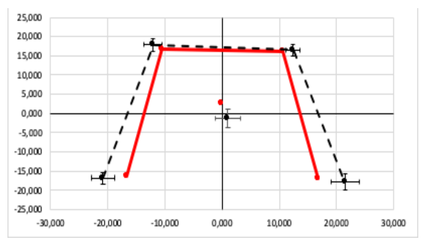
Carestream - CS 3700



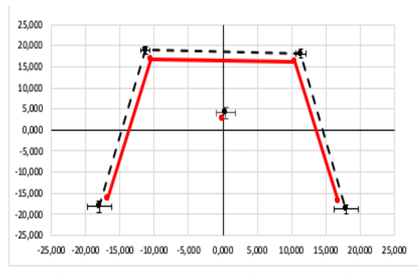
Medit – i700



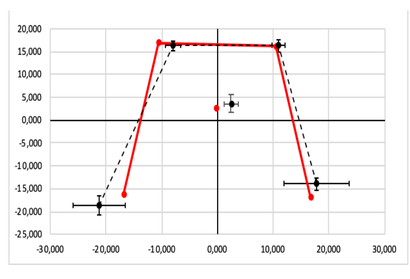
MyScan - Cefla



Trios 5 – 3Shape



Primescan – Dentsply



Vistascan- ivoclar

Graphs showing the accuracy of each scanner on the occlusal plane: the reference model frame is shown in red, and the scans are represented bly black dashed lines. The error is magnified 100 times in each image.

CONCLUSIONS

Except for MyScan, all scanners demonstrated accuracies below 50 µm, meeting the most severe requirements for fixed prosthodontics.
The most reliable scanners were found to be the Primescan – Dentsply (29.74 ± 13.95 µm) and the i700 – Medit (29.97 ± 9.84 µm).
In general, all scanners tested appeared unaffected by the operator's level of clinical experience.

niccolo.bagnaresi@studio.unibo.it